Loss / Near Loss (L/NL)

Loss/Near Loss ID : 38106 **Status :** Closed

Short Description : RIC/Cracking/Alky/V-1440 Lost

Responsible Organization : MFG|RIC|Ops|Crkq ABU|Gen Spt(RICREF)

Loss Type : Loss

Actual Severity Classification (Loss Only) : Level 2 **Potential Severity Classification :** Level 2

Location of Loss/Near Loss : Rich|Crack | LPG/Alky | Alky Unit

Date/Time Occurred : 4/17/2012 12:00:00 AM

Date/Time Reported : 4/17/2012 12:00:00 AM

Process Safety Related Event : No

Type of Activity : Operations

Loss/Near Loss Description : V-1440 (Acid Wash Drum) Electrostatic Precipitator went to ground (failed) on March 9, 2012. Unit was shut down to open, inspect and repair the ESP on April 12, 2012 with feed in on April 19, 2012

LPS Alert or Bulletin : No Alert/Bulletin Needed

Immediate Corrective Action Taken : none

Injury not OSHA-reportable to the Responsible Organization's Site : No

Address 1 :

Address 2 :

Address 3 :

City :

Country :

State/Province :

Zip/Postal Code :

Date Entered : 5/22/2012 2:42:33 PM

Entered By : MCGREEVY, EVAN (MCGR)

Required for Transportation (MVC) Losses

Weather :

Temperature : 32 to <80 F (0 to <27 C)

Lighting :

Loss Subtypes

Loss

Business Process

Responsibilities

Supervisor/Lead Responsible : MOORE, RONALD - RNAM

Loss / Near Loss (L/NL)

Management Sponsor : GUTTCHEN, RICH - JGUT

Injury/Illness Coordinator :

Reported By : MCGREEVY, EVAN - MCGR

Equipment

Equipment Involved	Critical	Comment
Electrical: Electrical Miscellaneous: Insulator	Yes	V-1440 Internal ESP

Attachments / Links

Module	ID	Type	File Name / Link	Comment/Description	Upload Date
Investigation	24137	LINK	https://collab001-hou.sp.chevron.net/sites/dsgmfgoe/LPSOut/RIDocLib/Final%20TapRooT.pdf	Final TapRooT Report	6/21/2012 7:52:51 PM

Consequences

ID	Type	Party Involved	Status
5420	Business Process		

Consequence - Business Process

Business Process ID : **5420**

Subtypes : Business Interruption

Description : Incident resulted in an unplanned outage to restore failed system

Financial Costs

Date	Type	Cost Category	Cost (USD)	Net Cost	Ownership Percentage	Details
5/29/2012 12:00:00 AM	Estimated/Planned	Expense Impact	100,000.00	100,000.00	100	Maintenance repair costs of cleaning entering and restoring vessel to operational condition
6/11/2012 12:00:00 AM	Estimated/Planned	Revenue or Gross Margin Impact	1,052,419.00	1,052,419.00	100	Cost of C4 vaporization associated with Alky outage

COI

Required for amounts over $100,000

Revenue (lost production X price) or gross margin (lost product sales - raw materials) impact- US$: 1052419

Expense Impact - Variable Cost, Property Damage, Incremental Costs-US$: 100000

Loss / Near Loss (L/NL)

Incremental Capital Impact (Portion of Capital Expenditures in lieu of repair or replacement expenses)-US$: 0

Estimate of Potential Impact to CVX Earnings as Equity Share or Working Interest-After Tax-US$: 0

Lost Production (BOEG) : 0

Incident Category : Equipment - I and E

If other, describe : Internal electrical ESP grid failed

What type of equipment initiated the COI incident? : Electrical / Instrumentation(except elect motors)

If other, describe :

Was this Incident Controllable? : No

Was this Reliability related? : Yes

Contact Name : Ron Moore

Contact Number : 510 242-3931

Investigation

Investigation ID : **24137**

Status : Closed

Investigation Date : 5/22/2012 12:00:00 AM

Type : TapRoot

Sensitive/Commercial : No

Responsibilities

Investigation Team Lead : LEEDS, LAURA - LFAA

Primary Contact : MOORE, RONALD - RNAM

Management Sponsor : MCGREEVY, EVAN - MCGR

Reviewer(s) :

Investigation Team Member(s) : MOORE, RONALD - RNAM

Taproot™ Facilitator : LEEDS, LAURA - LFAA

Loss / Near Loss (L/NL)

OE Tenets & Processes	
OE Tenets Violated	**Note**
06-Maintain integrity of dedicated systems	
OE Processes Implicated *	**Note**
Not in List/None	

Root Cause

Root Cause	Factors	Solution / Action Item Id	Solution / Action Item Status	Solution / Action Item Due Date
The insulators were were approximately 10 years old. Age related degradation (Casual Factor 1)	G. Inadequate tools or equipment: 5-Equipment is not maintained (preventive maintenance, etc)	157184	In Progress	10/31/2012 12:00:00 AM
		157185	Closed	8/31/2012 12:00:00 AM
Flow is lost to the ESP insulator housing for 40 hours (Casual Factor 3)	G. Inadequate tools or equipment: 3-Equipment is not designed properly	157186	In Progress	12/21/2012 12:00:00 AM
		157187	In Progress	12/31/2012 12:00:00 AM
No corrective actions were taken to ensure OEM evaluation from 2000 S/D were noted and acted upon to prevent future failures of the insulators. (Casual factor 2)	F. Inadequate communication of expectations regarding procedures or standards: 7-Management failed to be made aware of an issue as a result of poor lines of communication between employees and Management.	157188	Closed	7/30/2012 12:00:00 AM
Position of the rag layer is unknown in the vessel (Assumption Casual Factor 4)and Existing procedure to remove rag layer is not adquate to ensure rag layer is gone. Since this causal factor cannot be factually tied to the root cause of this failure, it is only considered in this investagation as an area for improvement in order to avoid future failures of the ESP.	E. Lack of or inadequate procedures: 4-Procedure/acceptable practice exists and technically right, but needs to be improved (improve clarity, cover additional scenario/steps, etc)	157189	In Progress	10/25/2012 12:00:00 AM

Solution/Action Item

Solution/Action Item ID : 157184

Status : In Progress

Source : Investigation

Source ID : 24137

Responsible Organization : MFG|RIC|Ops|Crkq ABU|Gen Spt(RICREF)

Sensitive/Commercial : No

Root Cause : The insulators were were approximately 10 years old. Age related degradation (Casual Factor 1)

Factor : G. Inadequate tools or equipment : 5-Equipment is not maintained (preventive maintenance, etc)

Solution Type (user entered) : LPS: Organizational

Solution : The BIN shall discuss if it is appropriate to write insulators shall be replaced every 5 years as required in the best practice for ESPs.

Loss / Near Loss (L/NL)

Date Assigned : 6/21/2012 12:00:00 AM

Due Date : 10/31/2012 12:00:00 AM

Completion Date :

Action Taken :

V&V Date :

V&V Comments :

Person Responsible : MATHUR, STEVE - SSMS

Supervisor/Lead Responsible : CABRERA, JAIME - JAIC

Solution/Action Item

Solution/Action Item ID : **157185**

Status : Closed

Source : Investigation

Source ID : 24137

Responsible Organization : MFG|RIC|Ops|Crkq ABU|Gen Spt(RICREF)

Sensitive/Commercial : No

Root Cause : The insulators were were approximately 10 years old. Age related degradation (Casual Factor 1)

Factor : G. Inadequate tools or equipment : 5-Equipment is not maintained (preventive maintenance, etc)

Solution Type (user entered) : LPS: Organizational

Solution : The shutdown recommendation for V-1440 ESP will be updated to include S/D PM that will be implemented every 5 years to replace the insulators. This will include all instructions listed in the existing best practice, but adding the replacement of the insulators every 5 years.

Date Assigned : 6/21/2012 12:00:00 AM

Due Date : 8/31/2012 12:00:00 AM

Completion Date : 8/28/2012 12:00:00 AM

Action Taken : Shutdown EWO has been written to include replacement of high voltage bushing, two insulators and one spring contact. This will be a S/D PM which will take place every 5 years. filepath <\\RIC841NTSHARE1.RIC841.CHEVRONTEXACO.NET\SHARE\Erg\Mod-only\Electrical Reliability\GDT\IMPACT Shutdowns\Cracking\ALKY - V-1440 ESP>

V&V Date : 8/28/2012 12:00:00 AM

V&V Comments : signed off on the Maximo SD PM add request and was submitted to reliability engineer for review and submittal to IMPACT

Person Responsible : CAVALLI, STEVEN - TKTZ

Supervisor/Lead Responsible : CABRERA, JAIME - JAIC

Loss / Near Loss (L/NL)

Solution/Action Item

Solution/Action Item ID : 157186

Status : In Progress

Source : Investigation

Source ID : 24137

Responsible Organization : MFG|RIC|Ops|Crkq ABU|Gen Spt(RICREF)

Sensitive/Commercial : No

Root Cause : Flow is lost to the ESP insulator housing for 40 hours (Casual Factor 3)

Factor : G. Inadequate tools or equipment : 3-Equipment is not designed properly

Solution Type (user entered) : LPS: Organizational

Solution : Review new insulator housing re-design recommended by the OEM. Determine if this new design should be incorporated in 2015 S/D event.

Date Assigned : 6/21/2012 12:00:00 AM

Due Date : 12/21/2012 12:00:00 AM

Completion Date :

Action Taken :

V&V Date :

V&V Comments :

Person Responsible : LEEDS, LAURA - LFAA

Supervisor/Lead Responsible : MOORE, RONALD - RNAM

Solution/Action Item

Solution/Action Item ID : 157187

Status : In Progress

Source : Investigation

Source ID : 24137

Responsible Organization : MFG|RIC|Ops|Crkq ABU|Gen Spt(RICREF)

Sensitive/Commercial : No

Root Cause : Flow is lost to the ESP insulator housing for 40 hours (Casual Factor 3)

Factor : G. Inadequate tools or equipment : 3-Equipment is not designed properly

Loss / Near Loss (L/NL)

Solution Type (user entered) : LPS: Organizational

Solution : A review of the flush system operation shall be implemented to ensure constant flush to the insulator housing can be obtained until 2015.

Date Assigned : 6/21/2012 12:00:00 AM

Due Date : 12/31/2012 12:00:00 AM

Completion Date :

Action Taken :

V&V Date :

V&V Comments :

Person Responsible : BENFIELD, MARK - NOKJ

Supervisor/Lead Responsible : MOORE, RONALD - RNAM

Solution/Action Item

Solution/Action Item ID : **157188**

Status : Closed

Source : Investigation

Source ID : 24137

Responsible Organization : MFG|RIC|Ops|Crkq ABU|Gen Spt(RICREF)

Sensitive/Commercial : No

Root Cause : No corrective actions were taken to ensure OEM evaluation from 2000 S/D were noted and acted upon to prevent future failures of the insulators. (Casual factor 2)

Factor : F. Inadequate communication of expectations regarding procedures or standards : 7-Management failed to be made aware of an issue as a result of poor lines of communication between employees and Management.

Solution Type (user entered) : LPS: Organizational

Solution : Issue a bulletin about this failure and post to GMR and the BIN to ensure all other Alkylation units with ESPs can learn from this failure. Share corrective action and conditions that are potentially hazardous to the reliability of the ESP operation.

Date Assigned : 6/21/2012 12:00:00 AM

Due Date : 7/30/2012 12:00:00 AM

Completion Date : 7/15/2012 12:00:00 AM

Action Taken : Issued bulletin and bulletin is posted to Alerts/Bulletins page as well as GMR.

V&V Date : 7/28/2012 12:00:00 AM

V&V Comments : As action states, bulletin completed and posted.

Person Responsible : LEEDS, LAURA - LFAA

Supervisor/Lead Responsible : WISHEROP, THOMAS - TFWI

Loss / Near Loss (L/NL)

Solution/Action Item

Solution/Action Item ID : 157189

Status : In Progress

Source : Investigation

Source ID : 24137

Responsible Organization : MFG|RIC|Ops|Crkq ABU|Gen Spt(RICREF)

Sensitive/Commercial : No

Root Cause : Position of the rag layer is unknown in the vessel (Assumption Casual Factor 4)and Existing procedure to remove rag layer is not adquate to ensure rag layer is gone. Since this causal factor cannot be factually tied to the root cause of this failure, it is only considered in this investagation as an area for improvement in order to avoid future failures of the ESP.

Factor : E. Lack of or inadequate procedures : 4-Procedure/acceptable practice exists and technically right, but needs to be improved (improve clarity, cover additional scenario/steps, etc)

Solution Type (user entered) : LPS: Organizational

Solution : Review procedure with BIN leader to assess if more specific details should be included in the procedure to ensure the rag layer is removed per best practices.

Date Assigned : 6/21/2012 12:00:00 AM

Due Date : 10/25/2012 12:00:00 AM

Completion Date :

Action Taken :

V&V Date :

V&V Comments :

Person Responsible : MOORE, RONALD - RNAM

Supervisor/Lead Responsible : MCGREEVY, EVAN - MCGR

Stewardship

Loss/Near Loss Quality Review

Quality Review ID : 202022

Status : In Progress

Responsible Organization : MFG|RIC|Ops|Crkq ABU|Gen Spt(RICREF)

Date Conducted : 8/31/2012 12:00:00 AM

Created Date : 8/31/2012 3:18:15 PM

Loss / Near Loss (L/NL)

Steward's Additional Comments :

Steward (Responsibilities) : PETERSON, JAY - JAYP

Quality Review ID : **202023**

Status : Closed

Responsible Organization : MFG|RIC|Ops|Crkq ABU|Gen Spt(RICREF)

Date Conducted : 8/31/2012 12:00:00 AM

Created Date : 8/31/2012 3:19:42 PM

Steward's Additional Comments : Most excellent TapRoot - lots of comments in the QR but no significant issues - just lots of good work.

Steward (Responsibilities) : PETERSON, JAY - JAYP

Loss / Near Loss (L/NL)

Results		
Item / Name	**Result**	**Comments**
1. Writes thorough description of loss/near loss? *	Yes	Executive summary of the Loss was part of a TapRoot report. It was written very well. Covered all the relevent history, provided a narrative of the event, and was fairly concise for a complicated event. The investigation really could not start until the unit was S/D and the ESP opened. If we start the investigation 30 day clock at ~April 19 then it still appears the investigation took longer than the alloted time. It was classified as a Level 2 but the $1MM loss LPO and $100K direct cost make it a Level 3. It was investigated as a Level 3 with TapRoot so it is an administrative issue and not an investigation quality issue. In fact the TapRoot was very well done.
2. Identifies root cause(s) by explaining why the near loss or loss occurred? *	Yes	Comprehensive TapRoot event identified 3 root causes and a potential root cause that could not be proven but may generate value through proposed BIN discussions so it was good they documented it.
3. Selects factor(s) from the FSF that matches the root cause? *	Yes	Connected to factors but I personally always find the foce fit between TapRoot and LPS to be clunky.
4. Develops solution(s) that matches the factor and addresses root cause? *	Yes	Multiple solutions for the root causes. All well designed to address learning opportunities, design opportunities, operational issues with flush.
5. Solution is feasible and maintainable? *	Yes	They should all be feasible and maintainable. One of the solutions called for replacement of the insulators every S/D per BIN leader recommendation while the OEM only asks for inspection and replacement if required. I always get suspicious if we get more conservative than the OEM. The OEMs benefit from reputation if their equipment runs well and often times parts/consultation is profitable so they are generally risk averse on recommendations. With the root causes related to flush flow and flush quality it would seem that we should fix those first before treating the symptom of insulator failure. In any case, the bulletin and the dialogue at the BIN meeting should drive the right solutions for the system and Richmond.
6. Appropriate reviewers assigned? *	Yes	RBM as sponsor with a strong investigation team and Section Head as approver. Just right!

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Memorandum

To Rich Guttchen

From Laura Leeds

Date June 19, 2012

Re Tap RooT® Investigation – IMPACT ERM Loss ID #38106

Alky- V-1440 ESP Failure

Table of Contents

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Incident Description:

The Electrostatic Precipitator in V-1440 suddenly failed on March 9, 2012. The ESP had been operating with no issues since the 4Q2010 Alky Major. The Cracking ABU then consulted with the BIN leader on how long the ESP could be out of service and safely operate the unit. It was decided that the unit could run for 5 more weeks until a planned outage was completed to repair the ESP on April 18th.

During the 5 week period of operation without the ESP, refinery oils planning were required to continue to meet Alkylate demands that were being asked of Richmond. Cracking ABU was committed to meeting these demands however, 5 days before the planned S/D of the Alky plant on April 13, a piping leak was found in the Alky plant that required the unit to S/D as the line could not be isolated for repair. This early S/D of the unit caused the refinery to miss meeting the Alkylate demands by utilizing the Alky to meet those demands and required the planning group to purchase Alkylate on the market at a higher cost. This resulted in a greater cost of incident.

Once the unit was shut down for inspection of the ESP V-1440, it was found that the insulators on the ESP (which help to provide electrical charge to the ESP grid) had failed as a result of tracking or going to ground. The tracking indications can be seen by visual inspection of the insulators. Only one of the two insulators on the ESP had failed. Once all other components of the ESP were tested for functionality, the only replacement that was required was replacement of the two insulators. All other components were found to be in working order.

This investigation discovered that the tracking on the insulators could be a result of three things: inadequate flush to the insulator housing, age of the insulators, and impurities in the insulator housing. The equipment manufacturer of the ESP recommends the use of clean constant flow flush to the insulator housing. Upon investigation of the flush system, it was found that the flush to V-1440 has had periods of no flush to the insulator housing unrelated to any plant upset or S/D, the most significant event was a 40 hour period from January 29 to February 2, 2011. When flush is lost, it does not cause an immediate failure, but it does start the tracking on the insulators as impurities or contaminants are now free to attach themselves to the insulators and begin creating a conductive environment. Over time this continuous act of tracking eventually causes a failure of the insulators, grounding the ESP. The investigation Team was not able to pinpoint what caused the loss of the flush as no plant issues were found and all turnovers only mentioned the flush was erratic; therefore, the team can only assume that the flush line was plugged for a short duration.

The age of the insulators as considered a factor for this failure as well as the insulators had not been replaced since 2000. The Alky BIN leader recommends that we replace these insulators every 5 year turnaround cycle to ensure we have fully functional insulators in the ESP. However, this recommendation was not clearly expressed in the Best Practice and was therefore not incorporated in turnaround recommendations. The equipment manufacturer of the ESP only recommends inspection of the insulators every 5 years and if needed, replacement. This has been done every 5 years since installation of the insulators per equipment manufacturer recommendations and guidance.

Lastly, the presence of impurities can lead to an eventual failure of the insulators. The impurities in this system are considered anything that is conductive but the main focus would be sulfuric acid. The equipment manufacturer for the ESP says that the impurities can come from two places in this type of system, either the flush has the impurities or the vessel interface layer or rag layer(sulfuric acid/hydrocarbon) has come in contact with the ESP grid and the insulators. The investigation team could not determine if the interface layer in V-1440 ever came in contact with the ESP grid or insulator housing as there is no reliable level indication that can find the height or presence of the interface layer. The existence and determination of the height of this interface layer is a common issue in all Alkylation plants. However, the investigation team did find that the procedure for removing the interface layer in the vessel needs improvement to ensure this interface layer is removed from the vessel. Currently, the procedure does not have enough detail to completely remove the interface layer from the vessel to be considered sufficient. Additionally, the investigation team could not determine if the flush system had more than normal amounts of sulfuric acid in the flush to cause this failure. However, the possibility that the flush line became plugged leads the team to believe it is possible the flush has more impurities in the system that normal. Because the several unknown factors around whether or not there were impurities in the insulator housing as a result of excessive sulfuric acid in the flush or if the interface layer came into contact with the ESP the investigation team cannot make thorough recommendations around elimination of the impurities.

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Applicable History of ESP:

V-1440 and the ESP were put in service in 1995 with the Alkylation plant. In 1999, there were records of having several plant upsets and issues around the V-1440 area. No additional details were found around what the cause of these upsets were. However, in the 2000 Alky Major S/D, the equipment manufacturer was performing routine S/D inspection of the ESP and their inspection found that the insulators had indications of tracking. The manufacturer recommended replacement of these insulators and stated that these tracking indications were likely tripping the ESP and causing the 1999 plant upsets that were being seen. The manufacturer had also stated some clear operating conditions for the flush system stating pressure and constant flush flow need to be maintained. However, from all information that the investigation team attempted to find, these recommendations were never acted upon or investigation into the failure of the insulators.

Every turnaround since 2000, the insulators have been inspected, cleaned and returned to service with no indications of tracking. So the insulators and all ESP components have been maintained per the equipment manufacturer recommendations where they have been inspected every 5 years and had appropriate PMs applied during turnarounds.

What Went Well:

-Response by Cracking ABU to involve all the right people once the ESP had failed to ensure they were making the right decision to continue to operate the unit

Immediate Corrective Actions:

-Created temporary operating parameters for the operators to monitor pH in the Alky downstream of the V-1440 in order to reduce the effects of the ESP being out of service as well as increasing the inspection monitoring program for downstream piping. These actions helped to control and mitigate potential corrosion downstream of the V-1440 as a result of excess sulfuric acid carryover.

Root Causes & Corrective Actions:

Causal Factor	TAPROOT Root Cause Path	Management System Affected	Corrective Action	Assign to Due By	Verification of C/A Effectiveness	Assign to Due By
#1: Insulators are 10 years old	Human Performance Difficulty/Management System/SPAC NI/Confusing or Incomplete SPAC	SPAC	The BIN shall discuss if it is appropriate to write insulators shall be replaced every 5 years as required in the best practice for ESPs.	Steve Mathur Oct 31, 2012	BIN submits updated best practice to include replacement of the insulators.	Jaime Cabrera Jan 31, 2012
#1: Insulators are 10 years old	Equipment Difficulty/ Preventative/Predictive Maintenance/ PM NI/ PM for		The shutdown recommendation for V-1440 ESP will be updated to include S/D PM that will be	Steve Cavalli August 31, 2012	Condition of the insulators will be assessed each	Jaime Cabrera Jan 2016

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	equipment NI		implemented every 5 years to replace the insulators. This will include all instructions listed in the existing best practice, but adding the replacement of the insulators every 5 years.		turnaround and documented in Meridium.	
#2: No corrective actions were taken to ensure OEM evaluation from 2000 S/D were noted and acted upon to prevent future failures of the insulators.	Equipment Difficulty/ Repeat Failure/Management System/ Corrective Action Needs Improvement /CA NI	Corrective Action Needs Improvement	Issue a bulletin about this failure and post to GMR and the BIN to ensure all other Alkylation units with ESPs can learn from this failure. Share corrective action and conditions that are potentially hazardous to the reliability of the ESP operation.	Laura Leeds July 30, 2012	Not Needed	
#3: Flow is lost to the ESP insulator housing for 40 hours	Equipment Difficulty/Design/ Design Review/ Design Review NI		Review new insulator housing re-design recommended by the OEM. Determine if this new design should be incorporated in 2015 S/D event.	Laura Leeds December 2013	Design was evaluated and then recommendations to the ABU were made.	Ron Moore January 2014
#3: Flow is lost to the ESP insulator housing for 40 hours	Equipment Difficulty Design Design Specs Design Not to Specs/Problem Not Anticipated		A review of the flush system operation shall be implemented to ensure constant flush to the insulator housing can be obtained until 2015.	Mark Benfield December 2012	A review is completed and recommendations are issued.	Ron Moore January 2013
#4: Position of the rag layer is unknown in the vessel	Human Performance Difficulty Procedures Followed incorrectly Details need improvement		Review procedure with BIN leader to assess if more specific details should be included in the procedure to ensure the rag layer is removed per best practices.	Ron Moore September 21, 2012	Procedure has been review by BIN and approved for use.	Evan McGreevy November 1, 2012

For more information on Causal Factors and Corrective Actions, see App II

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References & Attachments:

Appendix I - Tap RooT® Events & Causal Factors Chart®

Appendix II - RooT Cause Analysis®.

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Additional Information:

Investigation Team:

Name	Discipline / Role
Ron Moore	Alky Operations Assistant
Laura Leeds	Reliability Engineer/ Investigation Lead
Mark Benfield	Alky Process Engineer
Steve Cavalli	Electrical Analyst
Steve Mathur	Alky BIN

Date Event Began:

March 9, 2012

Business Units and Plants Affected:

Cracking ABU- Alky

Type of Incident *(From II&R Matrix)*:

Equipment Failure

Management Sponsor:

Rich Guttchen – Cracking Business Unit Manager

Tenets Followed:

8. Always address abnormal conditions

10. Always involve the right people in decisions that affect procedures and equipment.

Tenets Compromised:

6. Always maintain integrity of dedicated systems.

OE Processes Compromised:

- OE 2.2: Design for Reliability – Original design did not address or ensure constant flush with no impurities was available.
- OE 5.2/5.5/5.6: Risk Assessment and Asset strategy – Proper PM to replace every 5 years was not evaluated.

Cost of Incident (if applicable):

Direct Cost: $ K Lost Production: $ K Total Incident Costs: $

Causal Factor #1: Insulators are 10 years old

Background: On every S/D, the insulators have been inspected, cleaned and are replaced as needed per OEM findings and inspection. Of the three turnarounds that have occurred on V-1440, the insulators were replaced after the first 5 year run but have not been replaced since until this recent failure. The inspection of the insulators on the last two turnarounds showed no damage to the insulators and the inspection reports indicated the insulators were in good condition. The equipment manufacturer for ESPs states that insulators are not required to be replaced every 5 years and as long as they are inspected and proper operating conditions of the flush system are maintained, the insulators can last 15 years with no impact to the plant.

Condition	Guide	Basic Cause Category	Near Root Cause	Root Cause	Management System Affected (if any)	C/A	Assigned To Due By	Verification of C/A Effectiveness	Assigned To Due By
Insulators are12 years old at time of failure	Human Performance Difficulty	Management System	SPAC NI	Confusing or incomplete SPAC	SPAC	The BIN will be discussing if it is appropriate to write insulators shall be replaced every 5 years as required in the best practice for ESPs.	Steve Mathur Oct 31, 2012	BIN submits updated best practice to include replacement of the insulators.	Jaime CabreraJaime Cabrera
Insulators are12 years old at time of failure	Equipment Difficulty	Preventative/Predictive Maintenance	PM NI	PM for equipment NI		The shutdown recommendation for V-1440 ESP will be updated to include a S/D PM that will be implemented every 5 years to replace the insulators. This will include all instructions listed in the existing best practice, but adding the replacement of the insulators every 5 years.	Steve Cavalli August, 2012	Condition of the insulators will be assessed each turnaround and documented in Meridium.	Jaime Cabrera
Insulators are12 years old at time of failure	Equipment Difficulty	Preventative/Predictive Maintenance	PM NI	PM for equipment NI		A S/D PM will be added to Maximo to include the replacement of the insulators every 5 years to proactively maintain the reliability of the ESP system.	Steve Cavalli August 30,2012	Condition of the insulators will be assessed each turnaround and documented in Meridium.	Jaime Cabrera

Causal Factor #2: No corrective actions were taken to ensure OEM evaluation from 2000 S/D were noted and acted upon to prevent future failures of the insulators.

Background: In 1999, the Alky plant suffered from several plant upsets around V-1440, no root cause was identified or recorded. However, in the major S/D in 2000 where V-1440 and the ESP were internally inspected, the vendor stated that tracking indications drove him to replace the insulators in 2000 and is the likely suspect for why the plant upsets were occurring. He indicated that impurities in the system were the cause of these tracking indications.

Condition	Guide	Basic Cause Category	Near Root Cause	Root Cause	Management System Affected (if any)	C/A	Assigned To Due By	Verification of C/A Effectiveness	Assigned To Due By
OEM inspection findings were never acted upon after 2000 S/D replacement	Equipment Difficulty	Repeat Failure	Management System	Corrective Action Needs Improvement	CA NI	Issue a bulletin about this failure and post to GMR and the BIN to ensure all other Alkylation units with ESPs can learn from this failure. Share corrective action and conditions that are potentially hazardous to the reliability of the ESP operation.	Laura Leeds July 17, 2012	Not needed	

Causal Factor #3: Flow is lost to the ESP insulator housing for 40 hours

Background: Equipment manufacturer for the ESP states that a constant clean flush is needed in order maintain reliable operation of ESP. The Richmond flush system is noted to be variable in flow rate and pressure and has even had no flow over a period of 40 hours unrelated to any plant S/D. The service is relatively contaminant free, but we currently do not have data to tell us if the flush stream has more than acceptable amounts of sulfuric acid in the stream. Sulfuric acid and no flow can have negative effects on the reliability of the ESP insulators. These items can lead to contaminants attaching to the electrodes in the insulator housing allowing the system to go to ground or short. The contaminants or no flush to the system are not items that have immediate effect on the ESP, these items can lead to a failure over time.

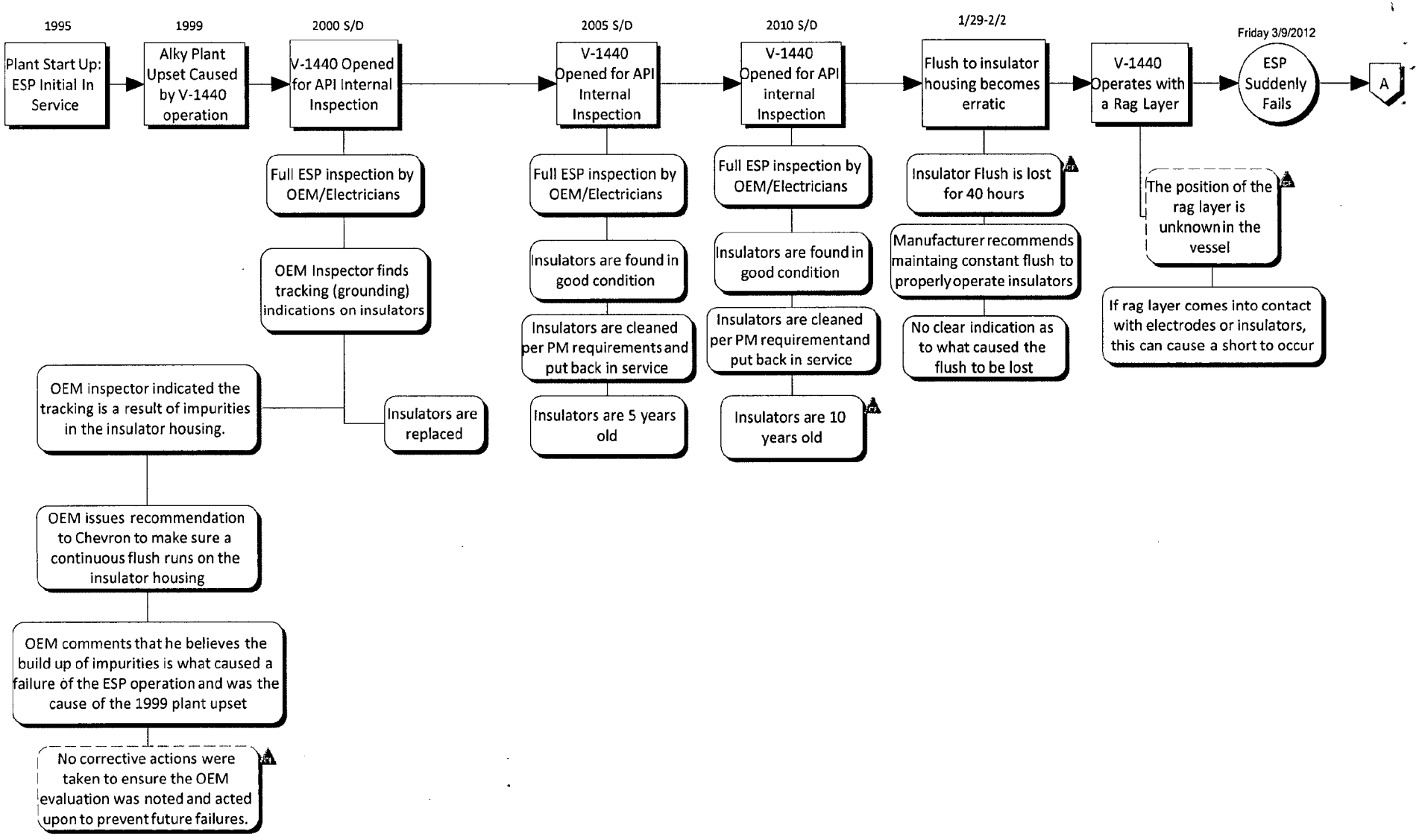
Condition	Guide	Basic Cause Category	Near Root Cause	Root Cause	Management System Affected (if any)	C/A	Assigned To Due By	Verification of C/A Effectiveness	Assigned To Due By
Flush is lost to the ESP housing	Equipment Difficulty	Design	Design Review	Design Review NI		Review new insulator housing re-design recommended by the OEM. Determine if this new design should be incorporated in 2015 S/D event.	Laura Leeds Dec 2015	Design was evaluated and then recommendations to the ABU were made.	Ron Moore
Flush is lost to the ESP housing	Equipment Difficulty	Design	Design Specs	Design Not to Specs/Problem Not Anticipated		A review of the flush system operation shall be implemented to ensure constant flush to the insulator housing can be obtained until 2015.	Mark Benfield Dec 2012		

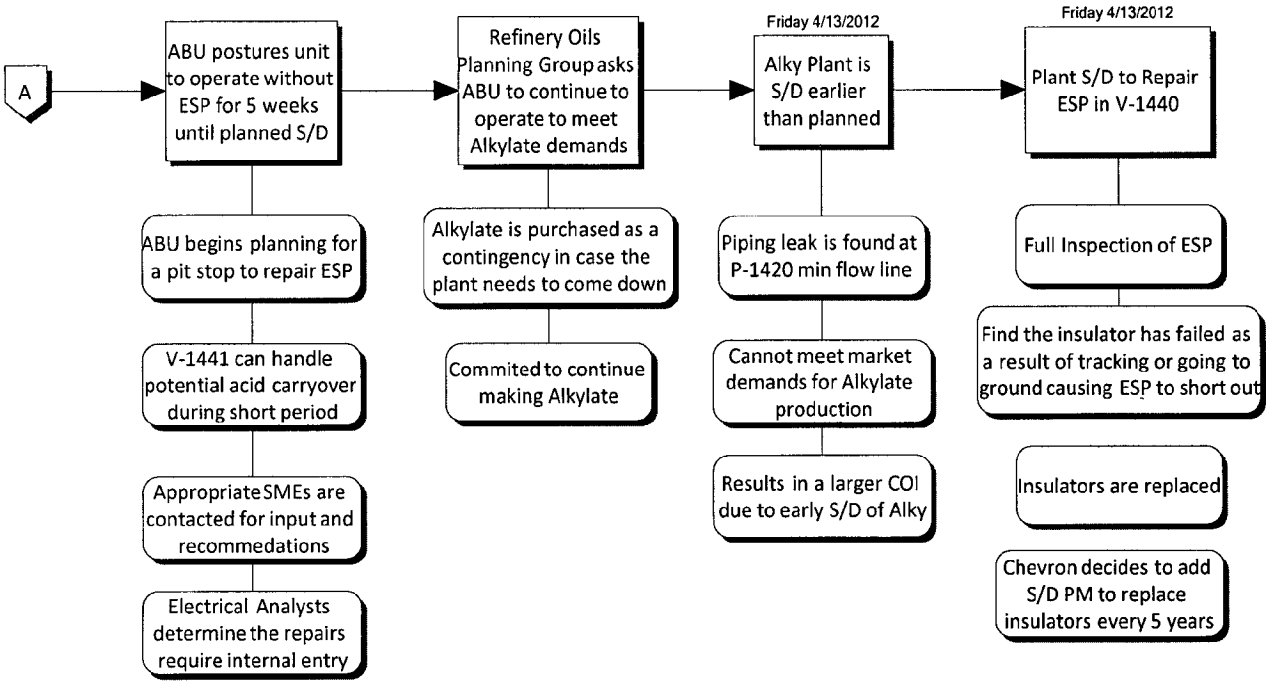
Causal Factor #4: Position of the rag layer is unknown in the vessel

Background: The alkylation process can create a rag layer or interface layer between the acid and the hydrocarbon in the vessel V-1440. The ESP manufacturer states that this rag layer must stay away from the ESP electrodes or it could cause a short to occur or cause a system malfunction, even in the insulator housing this rag layer can enter the insulator housing and cause an eventual failure. The manufacturer has seen in the past that the insulator housing becomes contaminated with impurities from the rag layer causing the ESP to short.

The level indication of the vessel has no way for operations to determine the height or presence of the rag layer. Therefore, there is an existing procedure where operations is to reduce the height of the rag layer by following a series of steps, however, the procedure does not specify a % level that needs to be removed from the vessel in order to ensure the rag layer has been removed. So operations will empty the vessel to nearly 10-15% empty, however, this is not completely dump the vessel as would be needed in order to remove the rag layer completely. So it is unknown at this time if the rag layer was in contact with the ESP or insulator housing as the procedure for dumping the rag layer does not completely describe in specific details on what level is needed to achieve the correct results.

Condition	Guide	Basic Cause Category	Near Root Cause	Root Cause	Management System Affected (if any)	C/A	Assigned To Due By	Verification of C/A Effectiveness	Assigned To Due By
The rag layer in V-1440 can interfere with the reliable operation f the ESP.	Human Performance Difficulty	Procedures	Followed incorrectly	Details need improvement		Review procedure with BIN leader to assess if more specific details should be included in the procedure to ensure the rag layer is removed per best practices.	Ron Moore September 15, 2012	Procedure has been review by BIN and approved for use.	Evan McGreevy


1995
Plant Start Up: ESP Initial In Service
1999
Alky Plant Upset Caused by V-1440 operation
2000 S/D
V-1440 Opened for API Internal Inspection
Full ESP inspection by OEM/Electricians
OEM Inspector finds tracking (grounding) indications on insulators
Insulators are replaced
OEM inspector indicated the tracking is a result of impurities in the insulator housing.
OEM issues recommendation to Chevron to make sure a continuous flush runs on the insulator housing
OEM comments that he believes the build up of impurities is what caused a failure of the ESP operation and was the cause of the 1999 plant upset
No corrective actions were taken to ensure the OEM evaluation was noted and acted upon to prevent future failures.
2005 S/D
V-1440 Opened for API Internal Inspection
Full ESP inspection by OEM/Electricians
Insulators are found in good condition
Insulators are cleaned per PM requirements and put back in service
Insulators are 5 years old
2010 S/D
V-1440 Opened for API internal Inspection
Full ESP inspection by OEM/Electricians
Insulators are found in good condition
Insulators are cleaned per PM requirementand put back in service
Insulators are 10 years old
1/29-2/2
Flush to insulator housing becomes erratic
Insulator Flush is lost for 40 hours
Manufacturer recommends maintaing constant flush to properlyoperate insulators
No clear indication as to what caused the flush to be lost
V-1440 Operates with a Rag Layer
The position of the rag layer is unknownin the vessel
If rag layer comes into contact with electrodes or insulators, this can cause a short to occur
Friday 3/9/2012
ESP Suddenly Fails
A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ABU postures unit to operate without ESP for 5 weeks until planned S/D
ABU begins planning for a pit stop to repair ESP
V-1441 can handle potential acid carryover during short period
Appropriate SMEs are contacted for input and recommedations
Electrical Analysts determine the repairs require internal entry
Refinery Oils Planning Group asks ABU to continue to operate to meet Alkylate demands
Alkylate is purchased as a contingency in case the plant needs to come down
Commited to continue making Alkylate
Friday 4/13/2012
Alky Plant is S/D earlier than planned
Piping leak is found at P-1420 min flow line
Cannot meet market demands for Alkylate production
Results in a larger COI due to early S/D of Alky
Friday 4/13/2012
Plant S/D to Repair ESP in V-1440
Full Inspection of ESP
Find the insulator has failed as a result of tracking or going to ground causing ESP to short out
Insulators are replaced
Chevron decides to add S/D PM to replace insulators every 5 years